Star formation suppression in compact group galaxies - DTU Orbit (08/11/2017)

Star formation suppression in compact group galaxies: a new path to quenching?

We present CO(1-0) maps of 12 warm H-2-selected Hickson Compact Groups (HCGs), covering 14 individually imaged warm H_2 bright galaxies, with the Combined Array for Research in Millimeter Astronomy. We found a variety of molecular gas distributions within the HCGs, including regularly rotating disks, bars, rings, tidal tails, and possibly nuclear outflows, though the molecular gas morphologies are more consistent with spirals and earlytype galaxies than mergers and interacting systems. Our CO-imaged HCG galaxies, when plotted on the Kennicutt-Schmidt relation, shows star formation (SF) suppression of <S > = 10 +/- 5, distributed bimodally, with five objects exhibiting suppressions of S greater than or similar to 10 and depletion timescales greater than or similar to 10 Gyr. This SF inefficiency is also seen in the efficiency per freefall time of Krumholz et al. We investigate the gas-to-dust ratios of these galaxies to determine if an incorrect L_{CO}-$M(H_2)$ conversion caused the apparent suppression and find that HCGs have normal gas-to-dust ratios. It is likely that the cause of the apparent suppression in these objects is associated with shocks injecting turbulence into the molecular gas, supported by the fact that the required turbulent injection luminosity is consistent with the bright H_2 luminosity reported by Cluver et al. Galaxies with high SF suppression (S greater than or similar to 10) also appear to be those in the most advanced stages of transition across both optical and infrared color space. This supports the idea that at least some galaxies in HCGs are transitioning objects, where a disruption of the existing molecular gas in the system suppresses SF by inhibiting the molecular gas from collapsing and forming stars efficiently. These observations, combined with recent work on poststarburst galaxies with molecular reservoirs, indicates that galaxies do not need to expel their molecular reservoirs prior to quenching SF and transitioning from blue spirals to red early-type galaxies. This may imply that SF quenching can occur without the need to starve a galaxy of cold gas first.

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